relative natural abundances of stable isotopes, and details of radioactive isotopes, including half-lives, modes of decay (alpha, beta, etc.) and gamma energies. The final table lists the binding energies of orbital electrons.

Generally, the work is well-presented. However, many, usually minor, lapses in clarity occur. It is apparent that most of the authors are not native English speakers; terms like 'experimentist' are common. Additionally, certain terminology used in this volume, such as 'magmatectonical setting', is not used universally. Typographical errors are also common, some chapters averaging perhaps one error per page. More seriously, terminology is occasionally explained poorly. Many diagrams are also reproduced poorly, although essential information is usually presented adequately. However, some exceptions occur, including figures that omit important details, such as axis labels.

Unfortunately, the format of the bibliographies will limit their usefulness. Each one lists entries in the order that they are first referenced within the text. Numbers, rather than authors' names, provide the means of cross-referencing. Furthermore, each entry omits a title and includes only the authorship, bibliographical source and date of the reference.

The first chapter, entitled 'Basics of nuclear science' is a major strength. This chapter occupies about 20% of the volume and provides fundamental information concerning nuclear processes. A further positive feature of the book is the detailed description of the theory underpinning each method appearing in chapters 2 to 9. However, some significant omissions and imbalances occur. Equally important analytical techniques may receive dramatically different levels of coverage. For instance, the book describes AMS in only 6.5 pages, but devotes 91 pages to Mössbauer spectroscopy. More serious are some notable omissions in the consideration of applications. The chapter entitled 'Radiometric methods for dating groundwater' is particularly restricted in scope. It is really only applicable to 'groundwater dating' in a very restricted sense, namely placing constraints on recharge times. Only ^{14}C, tritium and ^{85}Kr data are considered. In fact, 'groundwater dating' can also involve determinations of solute or water residence times within particular rock formations or structures, or solute residence times within the water. Such 'dating' can employ other radiometric methods for obtaining temporal information (e.g. methods based on ^{36}Cl, ^{129}I, U-series isotopes and ^{4}He). However, these methods are not considered in this chapter.

Many applications of the analytical methods are described. However, the volume as a whole is biased towards the theory behind these methods. It is also a pity that no chapter summarises the relative advantages and limtations of different analytical methods, or considers how different methods might complement one another. Similarly, within each chapter there could have been a more integrated treatment of each analytical method's advantages, limitations and applications. For example, the chapter on neutron activation analysis describes the ways in which some petrogenetic problems were addressed using trace element data. An appraisal of the unique advantages and drawbacks of NAA for acquiring such data to solve these particular problems would have been helpful. The most poorly integrated chapter is the one on 'isotopic palaeoclimatology'. Unlike others, this chapter considers no analytical methods, but describes how isotopic data constrain past climates within the time interval between the Quaternary and the Proterozoic. This overview is informative, but without being related specifically to the analytical methods considered elsewhere in the volume, the chapter is misplaced in this work.

Nevertheless, the editors and authors must be congratulated for producing a volume that covers many varied methods in considerable depth. The work should appeal primarily to mineralogists, petrologists and geochemists who already have a basic knowledge about the various 'nuclear methods' that are available, but who wish to acquire more in-depth information about these methods. This volume is probably too expensive to warrant purchasing by most individuals. However, the book should appear on the shelves of any serious earth science library.

R. METCALFE

Charlet, J.-M. (Ed.). *Centenary of the First Studies of the Shaba Geology (Zaïre) Stratabound Cu Deposits and Associated Mineralizations.* Brussels (Academie Royale des Science d'Outre-Mer), 1997, 482 pp. Price 900 BEF.

The volume contains 22 papers, of which 18 are in French and four in English, presented at the International Cornet Symposium in September 1994 at Mons in Belgium. This symposium

commemorated the pioneer work in the 1890s of Professor Jules Cornet in describing the geology and mineralisation potential of the Katangan copper belt. The volume runs to 482 pages and is characterized mainly by relatively short review papers. It is copiously illustrated but the small format means that some of the diagrams, particularly maps, are over-reduced and a little difficult to read. On a positive note, field photographs and photomicrographs are generally well reproduced. As the title suggests, the main theme of the volume is the geological setting, particularly in terms of sedimentology and tectonics, for the stratiform copper mineralisation of the Shaba district with comparisons with similar mineralisation from other parts of the world. The associated mineralisation includes papers on uranium and rare earth mineralisation, kimberlites occurring in Zaire (Kampata *et al.*), platinoid minerals found with the Cu-Co mineralisation (Jedwab), and the development of lateritic bauxites in Zaire (Kaseba *et al.*). A comprehensive review paper, with emphasis on research carried out between 1950 and 1980, by Francois sets the scene for Shaba geology. Papers by Dumont & Hanon and Brown give overviews of the tectonic and sedimentological settings, with the former authors suggesting that plate tectonic interpretations of Shaba geology based on a triple junction and aulacogen are premature. The latter author takes a more global viewpoint emphasising a rift setting in low latitudes with a change from early red-bed sedimentation to grey-bed marine and/or lacustrine sedimentation and the presence of evaporitic horizons. A number of authors (e.g. Okitaudji Lokoho; Dejonghe) regard the mineralisation as polyphase beginning with syn-diagenetic events, which commonly produce early pyritic mineralisation, followed by introduction of Cu-rich brines on growth faults and replacement of early pyrite, through to late-stage epigenetic remobilisation and development of mineral bodies in fault and fracture zones. The source of the Cu-rich brines is suggested by Madi-Lugali to result from the weathering of granitic bedrock, although Binda speculates that weathering of Pre-Katangan porphyry copper deposits could provide the brine source. Other authors describe similar deposits from Morocco (Mouttaqi & Sagon), Mexico (Zarate-Del Valle), Chile (Binda) and SW Sweden (Alm *et al.*). Papers on the associated uranium deposits of the Shaba district focus on the generation of hypersaline, oxidising residual fluids, and their capacity to remobilise uranium (Cailteux). Radiometric dating of uranium deposits (Loris *et al.*) to the late Proterozoic-Cambrian appears to support the remobilisation concept. Finally there are papers dealing with exploration for uranium using quartz thermoluminescence (Makabu *et al.*), a PC-based simulation of stratiform Cu-Co district which helps students to develop exploration strategies (Bauchau) and consideration of flotation problems arising from slime coating leading to loss of metals in fines (Kalenga). Overall the volume gives an up-to-date insight into current thinking on the geology of the Shaba copper belt and stratiform copper deposits in general and gives a very good introduction and review to the extensive range of publications, in French, on this important class of deposits. H. COLLEY

Rémond, G., Balk, L. and Marshall, D. J. (Eds.). *Luminescence*. Scanning Microscopy Supplement 9. Proceedings of the 13th Pfefferkorn Conference. Scanning Microscopy International, AMF O'Hare (Chicago), Il, USA. US$ 74.00. 1995, vi + 288 pp.

The 24 papers contained within this volume comprise a snap-shot of the state-of-the-art in a very wide range of applications of luminescence to inorganic materials covering several luminescence techniques. Most of the papers, all written by leading workers in the field, may be grouped under mineralogical, solid physics or technique headings, but palaeontological, archaeological, and environmental geochemistry applications are also represented. Most papers discuss cathodoluminescence (CL) or photoluminescence (PL), but ionoluminescence is also applied in one paper. Some papers highlight novel new applications of luminescence, whilst others indicate current progress for existing applications. The emphasis throughout is on the description, detailed explanation and discussion of the fundamental mechanisms which give rise to, or exert influence on, the measured or observed luminescence phenomena. The book is therefore aimed at those with a good level of knowledge. Luminescence date are frequently presented along with trace element data collected by PIXE, EPMA or e.p.r. The volume is well presented, with full reference lists and a useful subject index. Diagrams, spectra and photomicrographs are of almost uniformly high quality.

In the 10 mineralogical papers, the fundamentals of the CL and/or PL of zircon, quartz,